

CLAIMS

What is claimed:

1. An x-ray based non-intrusive inspection apparatus, comprising:
a support frame;
an object support secured to the support frame;
a gantry mounted to the support frame and being rotatable about a center axis (C) relative to an object held by the object support;
an x-ray source mounted to the gantry and providing x-rays that transmit through the object, the x-rays having an included angle between first and second shadow lines (L1; L2) such that a circle of reconstruction is formed upon rotation of the gantry having a radius (R) from the center axis (C) to a closest point (P1) on the first shadow line, a distance from the center axis (C) to a closest point (P2) on the second shadow line (L2) being less than the radius (R); and
a plurality of detectors located in a position to detect the x-rays after leaving the object.
2. The x-ray based non-intrusive inspection apparatus of claim 1, wherein the included angle is less than 75 degrees.
3. The x-ray based non-intrusive inspection apparatus of claim 1, wherein the radius (R) is at least twice the distance.

4. The x-ray based non-intrusive inspection apparatus of claim 1, wherein the distance is approximately 0 cm.
5. The x-ray based non-intrusive inspection apparatus of claim 1, comprising a plurality of x-ray sources mounted at different positions about the center axis.
6. The x-ray based non-intrusive inspection apparatus of claim 1, wherein the object support is a conveyor belt.
7. The x-ray based non-intrusive inspection apparatus of claim 1, wherein the detectors are on a curve having a center axis at the x-ray source.
8. The x-ray based non-intrusive inspection apparatus of claim 1, wherein the detectors are on a curve having a center axis that is not at the x-ray source.
9. The x-ray based non-intrusive inspection apparatus of claim 8, wherein the detectors are on a curve having a center axis at the center axis about which the gantry rotates.
10. The x-ray based non-intrusive inspection apparatus of claim 1, wherein the x-ray source includes a vacuum envelope, an electron source providing an electron

beam in the vacuum envelope, and a target having a surface on which the electron beam is directed, the surface, when viewed in cross-section in a plane of the center axis, being an angle other than normal to the electron beam so that the x-rays radiate toward the center axis.

11. The x-ray based non-intrusive inspection apparatus of claim 10, wherein, when viewed in cross-section at right angles to the center axis, a line from a center axis of and normal to the surface not passing through the center axis.

12. The x-ray based non-intrusive inspection apparatus of claim 11, wherein the line is located between a line passing through the center line and a line dividing the included angle in half.

13. An x-ray based non-intrusive inspection apparatus, comprising:
a support frame;
an object support secured to the support frames;
a gantry mounted to the support frame and being rotatable about a center axis (C) relative to an object held by the object support;
an x-ray source mounted to the gantry and providing x-rays having an included angle between first and second shadow lines (L1; L2), a point (P1) on the first shadow line (L1) closest to the center axis (C) being farther from the center axis

(C) and a point (P2) on the second shadow line (L2) closest to the center axis (C);
and

a plurality of detectors located in a position to detect the x-rays after leaving
the object.

14. A method of non-intrusively inspecting an object, comprising:

emitting x-rays from an x-ray source through the object;

rotating the x-ray source about a center axis (C) relative to the object, the x-
rays having an included angle between first and second shadow lines (L1; L2) such
that a circle of reconstruction is formed upon rotation of the gantry having a radius
(R) from the center axis (C) to a closest point (P1) on the first shadow line (L1), a
distance from the center axis (C) to a closest point (P2) on the second shadow line
(L2) being less than the radius (R); and

detecting the x-rays after leaving the object.

15. The method of claim 14, wherein the included angle is less than 75 degrees.

16. The method of claim 14, wherein the radius is at least twice the distance.

17. The method of claim 14, wherein the distance is approximately 0 cm.

18. The method of claim 14, wherein x-rays are emitted from a plurality of x-ray sources that, at a given moment, are located at various angles about the center axis.

19. The method of claim 14, further comprising conveying the object on a conveyor belt.

20. The method of claim 14, wherein the x-ray source rotates relative to a frame and the object does not rotate relative to the frame.

21. A method of non-intrusively inspecting an object, comprising:

emitting x-rays from an x-ray source through the object;

rotating the x-ray source about a center axis (C) relative to the object, the x-rays having an included angle between first and second shadow lines (L1; L2), a point (P1) on the first shadow line (L1) closest to the center axis (C) being farther from the center axis (C) than a point (P2) on the second shadow line (L2) closest to the center axis (C); and

detecting the x-rays after leaving the object.